
Space Weather Technical Forecast

Issued on Thursday, 09 November 2023 at 01:07 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Slight Chance of G1/Minor Geomagnetic Storms at first, but risk declining. Active fluence (1e8 integrated pfu) expected in the coming days. Chance of isolated M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been Low with only C-class flares observed in the last 24 hours, the largest of which came from the AR3483 region, peaking at C6.8 at 08/0848 UTC. There are five numbered and two unnumbered sunspot region on the visible disc. The largest region remains AR3477 which continues to be fairly stable. AR3479 in the northwest has decayed in recent hours, now Dri/Beta. AR3483, now Dai/Beta-Gamma, has continued to evolve with the lead/trailing portions showing consolidation, likely increasing the flare risk from this region in the coming hours/days. The remaining regions are small, simple and stable.

A prominence eruption from the NW limb at 08/0700 UTC has been analysed and is forecast to miss ahead of Earth's orbit. No other Earth directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: Solar winds at L1, as observed by DSCOVR and ACE, showed the continued impact of the high speed stream (HSS) associated with CH67/-. Wind speeds were strong, mainly between 600-700 km/s. Density was mostly at below average or below average levels. Total interplanetary magnetic field strength (Bt) was generally weak, between 4-8nT showing a slow decreasing trend. The north-south component (Bz) varied weakly between -6 and +7 nT. Phi angle has been predominantly negative (towards the Sun), with just a few brief variations. Geomagnetic activity has been generally Quiet to Unsettled (Kp 2-3), but with an isolated Active (Kp 4) from 0300-0600 as observed by BGS.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux has been at background levels over the last 24 hours. GOES16 high energy (greater than 2MeV) electron flux was at moderate levels initially, but briefly rose to high levels, peak 1.23e3 pfu at 08/1520UTC. The associated 24-hour fluence has been below the Active threshold (1e8 integrated pfu) and has remained fairly steady over the past 24 hours. The fluence observation at 09/0000 UTC was 4.76e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Generally Low solar activity is expected through the period, but with a chance of isolated M-class flares.

Solar Wind / Geomagnetic Activity: No CMEs currently forecast to reach Earth. Strong wind speeds are likely to continue through Day 1 (9 Nov) due to the ongoing HSS from CH67/-, before a gradual decline through Days 2 and 3 (10-11 Nov).

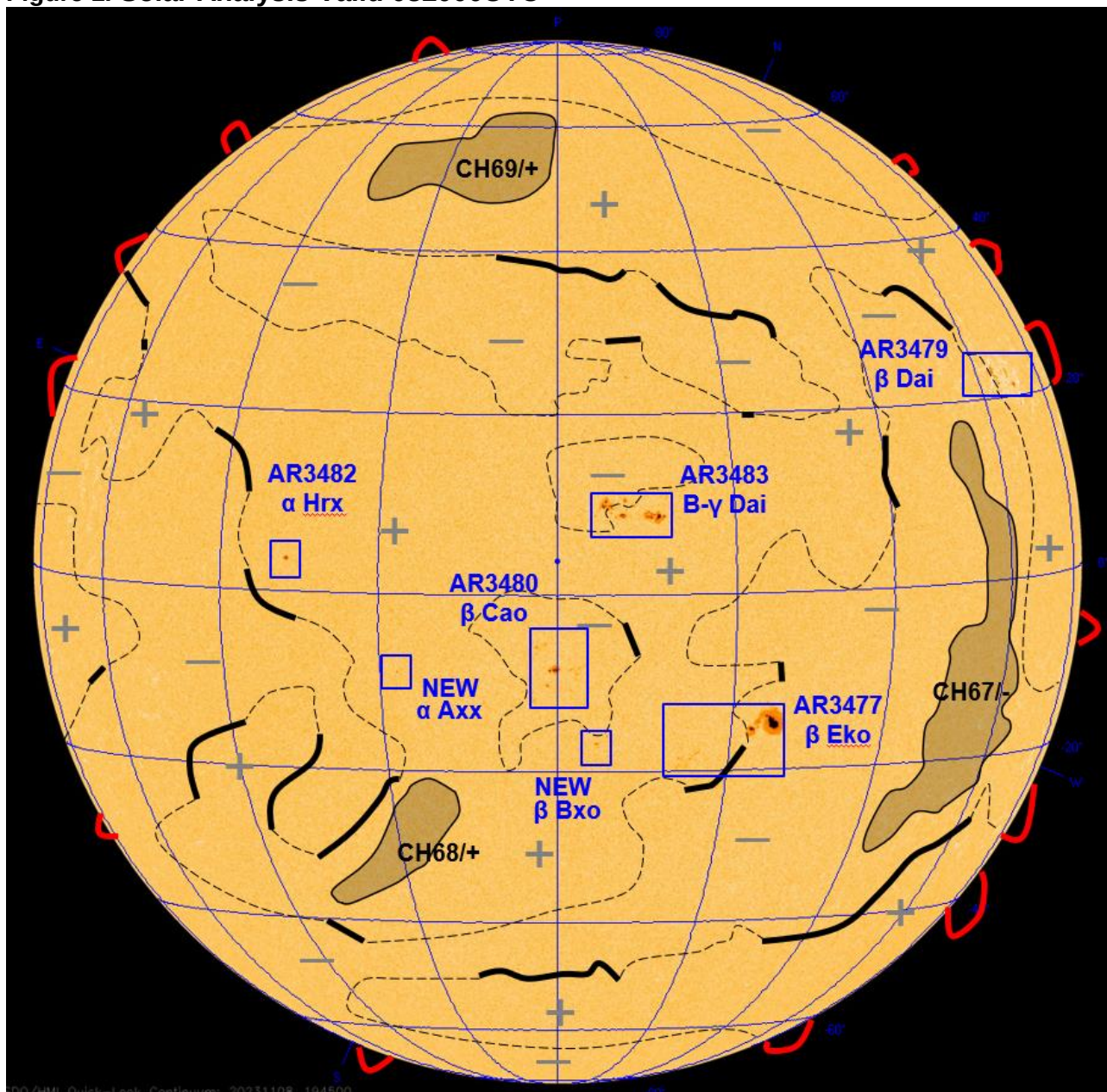
Geomagnetic activity expected to be generally Unsettled (Kp3) initially, with a slight chance of further isolated G1/Minor Storm intervals (Kp5) on Day 1. This risk reducing into the period with activity expected to gradually decline through the following days as the HSS eases to generally

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Quiet (Kp1-2) levels.

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is most likely to remain at background levels. High energy electron flux (greater than 2MeV) is currently at moderate to high levels and expected to remain so through the remainder of the period. The associated 24-hour electron fluence is expected to be just below the Active threshold at first, but with an expectation of exceeding the Active (1e8 integrated pfu) threshold by later Day 1 (9 Nov) and remaining so through the rest of the period, with a slight chance of reaching 1e9 integrated pfu.

Figure 1. Solar Analysis Valid 082000UTC



Key: Filament —, Prominence —, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

No Earth directed CMEs are currently forecast. A prominence eruption from the NW limb at 08/0700 UTC has been analysed and is forecast to miss ahead of Earth's orbit. Solar wind speeds are around 700 km/s, due to the ongoing influence of a HSS from coronal hole CH67/-. Winds are expected to continue at strong levels through Day 1 (9 Nov) before beginning to decline from Day 2 (10 Nov) onwards. Some uncertainty does come in to the forecast regarding this easing due to the shape of CH67, with its southern portion sloping eastwards, which could see stronger solar winds lingering as this portion traverses westward. MOSWOC Enlil modelling currently viewed as providing reasonable guidance for the coming period.

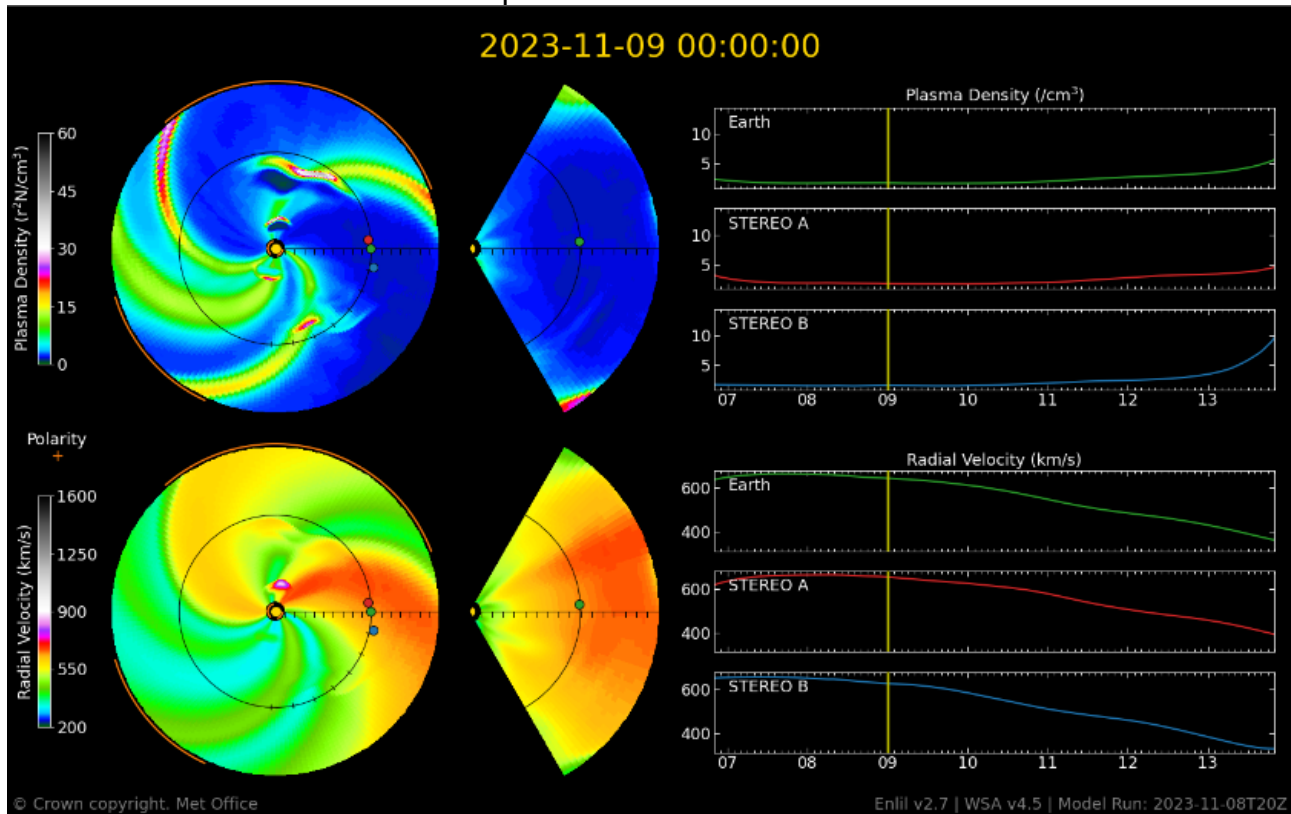
Geomagnetic activity expected to be generally Unsettled initially, with a slight chance of further isolated G1/Minor Storm intervals on Day 1. This risk reducing into the period with activity expected to gradually decline through the following days as the HSS eases, to generally quiet levels.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	15	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2:
Latest MOSWOC ENLIL model output



Radio Blackouts - X-Ray Flares:

Activity has been Low with only C-class flares observed in the last 24 hours. AR3483 was responsible for the largest flare, peaking at C6.8 at 08/0848 UTC. Generally Low activity expected to continue but with a chance of isolated M-Class flares, most likely from AR3483, along with the continued threat presented by the larger AR3477 in the southern hemisphere. No further large regions are expected to rotate onto the visible side of the Sun during the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is expected to persist at background levels. There is a slight risk of proton enhancement from any larger flares. From Day 3 sunspots AR3477 and AR3483 will be transiting into a more favourable western longitude giving a slight enhancement to an S1 or greater event.

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	10	10
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm⁻²sr⁻¹s⁻¹)

High Energy Electrons Event ($\geq 2\text{MeV}$):

High energy electron flux (greater than 2MeV) has risen to moderate to high levels, following an expected flux increase in the radiation belt due to the ongoing HSS, with high levels expected to occur during the daytime maximums.

The associated 24-hour electron fluence is expected to be just below the Active threshold at first, but with an expectation for it to exceed the Active ($1\text{e}8$ integrated pfu) threshold by later Day 1 (9 Nov) and remaining so through day 2, with a slight but increasing chance of reaching $1\text{e}9$ integrated pfu. Fluence likely to gradually decreased through the latter part of the period as the HSS effect diminish. Overall trend of the MOSWOC REFM model looks good for the next few days, although total fluence is considered over forecast.

GEO Electron Environment	Level ($\text{cm}^{-2}\text{sr}^{-1}\text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2\text{ MeV}$ $\geq 1\text{x}10^8$	No	90	90	80	70
Very Active	$\geq 2\text{ MeV}$ $\geq 1\text{x}10^9$	No	5	10	5	1

Figure 3: Latest MOSWOC REFM output

